Section 5. Renewable Energy

Renewable energy sources included in the State Energy Data System (SEDS) comprise wood, waste, hydroelectric, geothermal, wind, photovoltaic, solar thermal energy and ethanol. Renewable energy consumption estimates for all sectors are available for 1960 forward.

Ethanol

The transportation sector uses ethanol as an additive to motor gasoline. Ethanol can be derived from sugar cane, sugar beets, corn, sweet sorghum, wheat, and other grains. The U.S. total in SEDS is a series developed by the Energy Information Administration (EIA) from annual reports of field production of oxygenated gasoline and refinery input of ethanol. The State data series, used to allocate the U.S. total to the States, is based on the U.S. Department of Transportation, Federal Highway Administration data series published in *Highway Statistics,* which represents ethanol consumed in gasohol for 1993 forward and total gasohol sales in earlier years. In 2002, ethanol consumed in gasohol is not available from *Highway Statistics*. The ratios of each State's ethanol in gasohol consumption to total gasohol consumption are calculated for 2001 and 2003. The two ratios for each State are averaged and applied to each State's 2002 total gasohol consumption to derive the amount of ethanol consumed in gasohol in 2002. Ethanol and gasohol data for Florida, Massachusetts, and Rhode Island are available for only one of the two years used to estimate 2002; in these instances, the ratio of only the available year is used.

Ethanol estimates are maintained separately from motor gasoline in SEDS, from 1981 forward, and shown in the State energy consumption data tables to illustrate renewable energy use, but ethanol consumption volumes are already accounted for within the motor gasoline data series, in 1993 forward. The ethanol data series are identified in SEDS by the following names ("ZZ" in the variable name represents the two-letter State code that differs for each State):

ENTRPZZ = ethanol blended into motor gasoline (1993 forward) or total gasohol sales (1982 through 1992) by State, in thousand gallons; and
ENACPUS = ethanol consumed in the transportation sector in the United States, in thousand barrels.

The U.S. total of the State series, ENTRPZZ, is calculated as the sum of the State data. The U.S. value, ENACPUS, is allocated to the States in proportion the *Highway Statistics* State estimates, ENTRPZZ:

ENTRPUS = ΣENTRPZZ
ENACPZZ = (ENTRPZZ / ENTRPUS) * ENACPUS

Ethanol is converted to equivalent British thermal units (Btu) by using a conversion factor of 3.539 million Btu per barrel.

ENACBZZ = ENACPZZ * 3.539
ENACBUS = ΣENACBZZ

Data Sources

ENACPUS — Ethanol consumed by the transportation sector in the United States.

- 1960 through 1980: No data are available. Values are assumed to be zero.
- 1981 through 1992:
  - — 1981, 1984, 1987, and 1989: EIA, *Estimates of U.S. Biofuels Consumption 1990*, Table 10.
  - — 1982 and 1983: EIA, Office of Coal, Nucear, Electric, and Alternate Fuels estimates.
  - — 1985, 1986, 1988, and 1991: Values interpolated.
  - — 1990 and 1992; EIA, *Estimates of U.S. Biomass Energy Consumption 1992*, Table D1.

- 1993 forward: EIA estimates based on data in the EIA *Petroleum Supply Annual, (PSA)* Tables 2 and 16. Ten percent of the "Field Production" of "Oxygenated Finished Motor Gasoline" from the *PSA* Table 2 is added to the "Refinery Input of Fuel Ethanol" from the *PSA* Table 16. The sum is multiplied by the conversion factor of 3.539 million Btu per barrel of fuel ethanol.

ENTRPZZ — Ethanol blended into motor gasoline by State.

- 1960 through 1980: Values are set to be zero.
- 1981 through 1992: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics, Summary to 1995,* Table MF-233GLA.
- 1993 through 1995: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics, Summary to 1995,* Table MF-233E, column titled "Total Ethanol Used in Gasohol."
- 1996 through 2001, 2003: U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics*, annual reports, Table MF-33E, column titled "Total Ethanol Used in Gasohol."
- 2002: EIA estimates based on the 2001 and 2003 data from *Highway Statistics,* see discussion on previous page.

Geothermal

Geothermal energy used as direct heat or from heat pumps in the residential, commercial, and industrial sectors is included in the State Energy Data System (SEDS) for 1989 forward. SEDS consumption in the electric power sector includes geothermal energy input at electric utilities for all years, 1960 forward, and includes geothermal energy used to generate electricity by nonutility power producers for 1989 forward. These data series are identified in SEDS by the following names ("ZZ" in the variable name represents the two-letter State code that differs for each State):

GECCBZZ = direct use of geothermal energy and heat pumps in the commercial sector by State, in billion British thermal units (Btu);

GEEGPZZ = electricity produced from geothermal energy by the electric power sector by State, in million kilowatthours;

GEICBZZ = direct use of geothermal energy and heat pumps in the industrial sector by State, in billion Btu; and

GERCBZZ = direct use of geothermal energy and heat pumps in the residential sector by State, in billion Btu.

The U.S. totals for the State-level series are calculated by summing the State data:

GECCBUS = ΣGECCBZZ
GEEGPUS = ΣGEEGPZZ
GEICBUS = ΣGEICBZZ
GERCBUS = ΣGERCBZZ

To convert electricity produced from geothermal energy from kilowatthours into comparable Btu, a U.S. average factor that varies by year is used. The values for the factor, GEETKUS, are shown in Appendix B, Table B1, http://www.eia.doe.gov/emeu/states/_seds_updates_tech_notes.html.

GEETKUS = factor for converting electricity produced from geothermal energy from kilowatthours to Btu.

The values for the electric power sector in each State are converted to Btu and the U.S. total is the sum of the State data:

GEEGBZZ = GEEGPZZ * GEETKUS
GEEGBUS = ΣGEEGBZZ

The State totals for geothermal energy are the sum of the residential, commercial, and industrial sectors' use and the electric power sector's geothermal-based generation. The U.S. total is the sum of the State data.

GETCBZZ = GERCBZZ + GECCBZZ + GEICBZZ + GEEGBZZ
GETCBUS = ΣGETCBZZ

Additional Note

Geothermal energy from direct use and heat pumps in the residential, commercial, and industrial sectors are from the Oregon Institute of Technology Geo-Heat Center. State data for 1989 and 1994 are based on surveys of geothermal equipment producers, distributors, and installers and State energy offices. State estimates from 1998 through 2002 are developed by the Geo-Heat Center from discussions with industry sources.

The State data for 1989, 1994, and 1998 are used by the Energy Information Administration (EIA) to estimate the State values for intervening years. States with the same value in two survey years are assigned that value for each intervening year. For States with increases or decreases in the survey data, the difference is allocated evenly over the intervening years. If a State went from zero to a value or from a value to zero, it was given zero in the intervening years. The State data for each intervening year are summed and States with increasing or decreasing values are adjusted until the U.S. total equals the U.S. total estimated by the Oregon Institute of Technology Geo-Heat Center.

State data for 2003 are estimated by EIA by calculating the ratios of the 2002 State values for each sector to the 2002 U.S. sector totals and applying those State ratios to the 2003 U.S. sector totals.

Data Sources

GECCBZZ — Direct use and heat pump geothermal energy in the commercial sector.

- 1960 through 1988: No data available. Values assumed to be zero.
- 1989: Lund, John W., Oregon Institute of Technology Geo-Heat Center, unpublished tables, (Klamath Falls, Oregon: April 1999), based on a survey.
- 1990 through 1993: U.S. totals are estimates from the Oregon Institute of Technology Geo-Heat Center, unpublished tables. State data for 1989 and 1994 are used to estimate State values for the intervening years. For an the explanation of the estimation methodology, see the "Additional Note" on page 80.
- 1994: Lund, John W., Oregon Institute of Technology Geo-Heat Center, unpublished tables, (Klamath Falls, Oregon: April 1999), based on a survey.
- 1995 through 1997: U.S. totals are from the Oregon Institute of Technology Geo-Heat Center, unpublished tables. State data for 1994 and 1998 are used to estimate State values for the intervening years. For an the explanation of the estimation methodology, see the "Additional Note" on page 80.
- 1998 through 2002: Lund, John W., Oregon Institute of Technology Geo-Heat Center, Klamath Falls, Oregon, unpublished tables based on informal surveys and estimations.
- 2003: U.S. total is from the Oregon Institute of Technology Geo-Heat Center, unpublished table. State data are estimated by EIA using the ratios of the 2002 State values to the 2002 U.S. total.

GEETKUS — Factor for converting electricity produced from geothermal energy from physical units to Btu.

- 1960 through 1981: Calculated by EIA by weighting the annual average heat rates of operating geothermal units by the installed nameplate capacities as reported on Federal Power Commission Form 12.
- 1982 forward: Estimated annually by the EIA on the basis of an informal survey of relevant plants.

GEEGPZZ — Electricity produced from geothermal energy by the electric power sector for each State.

- EIA, Forms EIA-920, "Combined Heat and Power Plant Report," and EIA-906, "Power Plant Report," and predecessor forms.

GEICBZZ — Direct use and heat pump geothermal energy in the industrial sector.

- 1960 through 1988: No data available. Values assumed to be zero.
- 1989: Lund, John W., Oregon Institute of Technology Geo-Heat Center, unpublished tables, (Klamath Falls, Oregon: April 1999), based on a survey.
- 1990 through 1993: U.S. totals are estimates from the Oregon Institute of Technology Geo-Heat Center, unpublished tables. State data for 1989 and 1994 are used to estimate State values for the intervening years. For an the explanation of the estimation methodology, see the "Additional Note" on page 80.
- 1994: Lund, John W., Oregon Institute of Technology Geo-Heat Center, unpublished tables, (Klamath Falls, Oregon: April 1999), based on a survey.
- 1995 through 1997: U.S. totals are from the Oregon Institute of Technology Geo-Heat Center, unpublished tables. State data for 1994 and 1998 are used to estimate State values for the intervening years. For an the explanation of the estimation methodology, see the "Additional Note" on page 80.
- 1998 through 2002: Lund, John W., Oregon Institute of Technology Geo-Heat Center, Klamath Falls, Oregon, unpublished tables based on informal surveys and estimations.

- 2003: U.S. total is from the Oregon Institute of Technology Geo-Heat Center, unpublished table. State data are estimated by EIA using the ratios of the 2002 State values to the 2002 U.S. total.

GERCBZZ — Direct use and heat pump geothermal energy in the residential sector.

- 1960 through 1988: No data available. Values assumed to be zero.
- 1989: Lund, John W., Oregon Institute of Technology Geo-Heat Center, unpublished tables, (Klamath Falls, Oregon: April 1999), based on a survey.
- 1990 through 1993: U.S. totals are estimates from the Oregon Institute of Technology Geo-Heat Center, unpublished tables. State data for 1989 and 1994 are used to estimate State values for the intervening years. For an the explanation of the estimation methodology, see the "Additional Note" on page 80.
- 1994: Lund, John W., Oregon Institute of Technology Geo-Heat Center, unpublished tables, (Klamath Falls, Oregon: April 1999), based on a survey.
- 1995 through 1997: U.S. totals are from the Oregon Institute of Technology Geo-Heat Center, unpublished tables. State data for 1994 and 1998 are used to estimate State values for the intervening years. For an the explanation of the estimation methodology, see the "Additional Note" on page 80.
- 1998 through 2002: Lund, John W., Oregon Institute of Technology Geo-Heat Center, Klamath Falls, Oregon, unpublished tables based on informal surveys and estimations.
- 2003: U.S. total is from the Oregon Institute of Technology Geo-Heat Center, unpublished table. State data are estimated by EIA using the ratios of the 2002 State values to the 2002 U.S. total.

Hydroelectric Power

Electricity produced from hydropower is included in the State Energy Data System (SEDS) in the industrial and electric power sectors for all years, 1960 forward, and in the commercial sector for 1989 forward. In the electric power sector, there are two types of hydroelectric power. Conventional hydroelectric power uses falling water to drive turbines to produce electricity. With pumped storage hydroelectricity, energy is used to pump water into elevated storage areas during off-peak hours so that it can be released to drive turbines during times of peak electricity demand. Because pumped storage hydroelectricity uses energy, it is not included in energy consumption estimates, when it can be identified separately, to avoid double-counting. The hydroelectric power data series included in SEDS are identified by the following names ("ZZ" in the name represents the two-letter State code that differs for each State):

HVEGPZZ = electricity produced by conventional hydroelectric power in the electric power sector by State, in million kilowatthours;
HVC5PZZ = electricity produced by conventional hydroelectric power at commercial facilities by State, in million kilowatthours;
HVI5PZZ = electricity produced by conventional hydroelectric power at industrial facilities by State, in million kilowatthours;

The U.S. value for each of the series is the sum of the State data.

Total use of hydroelectric power in the commercial, industrial, and electric power sectors is assumed to be the electricity produced by conventional hydroelectric power. The U.S. total for each sector is the sum of the State values:

HYCCPZZ = HVC5PZZ
HYCCPUS = ΣHYCCPZZ

HYICPZZ = HVI5PZZ
HYICPUS = ΣHYICPZZ

HYEGPZZ = HVEGPZZ
HYEGPUS = ΣHYEGPZZ

Electricity produced from hydroelectric power is converted from kilowatthours to British thermal units (Btu) by using a conversion factor that is the U.S. average heat content of fossil fuels consumed at steam-electric power plants, FFETKUS. The annual values for this factor are shown in the Consumption Technical Notes, Appendix B, Table B1, http://www.eia.doe.gov /emeu/states/_seds_updates_tech_notes.html.

FFETKUS = factor for converting hydroelectric power from kilowatthours to Btu.

HYCCBZZ = HYCCPZZ * FFETKUS
HYICBZZ = HYICPZZ * FFETKUS
HYEGBZZ = HYEGPZZ * FFETKUS

The U.S. value for each of the series is the sum of the State data.

Total hydroelectricity consumption for each State is the sum of the commercial, industrial, and electric power sectors' generation.

HYTCPZZ = HYEGPZZ + HYCCPZZ + HYICPZZ
HYTCPUS = ΣHYTCPZZ

HYTCBZZ = HYEGBZZ + HYCCBZZ + HYICBZZ
HYTCBUS = ΣHYTCBZZ

Data Sources

FFETKUS — Fossil fuel steam-electric power plant conversion factor.

- 1960 through 1988: Estimated by EIA as the weighted annual average heat rate for fossil-fueled steam-electric plants in the United States as published in the EIA, *Electric Plant Cost and Power Production Expenses 1991*, Table 9.
- 1989 forward: Calculated annually by EIA on the basis of data from Form EIA-767 "Steam-Electric Plant Operation and Design Report."

HVC5PZZ — Electricity produced from conventional hydroelectric power at the commercial facilities by State.

- 1960 through 1988: No data available. Values are assumed to be zero.
- 1989 forward: EIA, Forms EIA-920, "Combined Heat and Power Plant Report," and EIA-906, "Power Plant Report," and predecessor forms.

HVI5PZZ — Electricity produced from conventional hydroelectric power at industrial facilities by State.

- 1960 through 1978: Federal Power Commission, Form 4, "Monthly Power Plant Report."
- 1979 and 1980: EIA estimates based on previous years' data.
- 1981 through 1988: No data available. The 1980 data are repeated for each year.
- 1989 forward: EIA, Forms EIA-920, "Combined Heat and Power Plant Report," and EIA-906, "Power Plant Report," and predecessor forms.

HVEGPZZ — Electricity produced from conventional hydroelectric power by the electric power sector (includes pumped storage hydroelectric power through 1989) by State.

- 1960 through 1977: Federal Power Commission, News Release, "Power Production, Fuel Consumption, and Installed Capacity Data."
- 1978 through 1980: EIA, *Energy Data Reports*, "Power Production, Fuel Consumption and Installed Capacity Data."
- 1981 through 1988: EIA, Form EIA-759, "Monthly Power Plant Report," and predecessor forms. The data rounded to gigawatthours are published in the following reports:
  - 1981 through 1985: EIA, *Electric Power Annual 1985*, Table 6.
  - 1986 and 1987: EIA, *Electric Power Annual 1987*, Table 18.
  - 1988 and 1989: EIA, *Electric Power Annual 1989*, Table 14.
- 1989 forward: EIA, Forms EIA-920, "Combined Heat and Power Plant Report," and EIA-906, "Power Plant Report," and predecessor forms.

Solar

Estimates of solar energy use for the residential and commercial sectors combined and the industrial sector are included in the State Energy Data System (SEDS) for 1989 forward. Generation of electricity by the electric power sector from solar energy sources is included in SEDS for 1984 forward.

Residential/Commercial Sector

Solar thermal energy use in the residential and commercial sectors combined in the United States is estimated by the Energy Information Administration (EIA) in billion British thermal units (Btu) and published in the EIA *Annual Energy Review* for 1989 forward. A State-level series for allocating the U.S. total to the States is developed by EIA from accumulated data on shipments of solar thermal collectors to States, measured in square

feet, as collected on the EIA Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey," and predecessor surveys. The data are published for recent years in the EIA *Renewable Energy Annual*. The assumption is made that the retirement/replacement period for solar thermal collectors is 20 years. The data series are identified in SEDS by the following names ("ZZ" in the variable name represents the two-letter State code that differs for each State):

SOTTPZZ = a rolling 20-year accumulation of shipments of solar thermal energy collectors by State, in square feet, and
SOHCBUS = energy produced by solar thermal and photovoltaic energy collectors in the residential and commercial sectors combined in the United States, in billion Btu.

The U.S. total of shipments of solar thermal energy collectors is calculated as the sum of the State data, and the U.S. total residential/commercial solar energy is allocated to the States as follows:

SOTTPUS = ΣSOTTPZZ
SOHCBZZ = (SOTTPZZ / SOTTPUS) * SOHCBUS

Electric Power Sector

The electric power sector includes estimates of electricity produced from photovoltaic and solar thermal energy sources by electric utilities from 1984 forward, and by both electric utilities and nonutility power producers from 1989 forward. The data series is identified in SEDS by the following name ("ZZ" in the variable name represents the two-letter State code that differs for each State):

SOEGPZZ = electricity produced from photovoltaic and solar thermal energy sources by the electric power sector, for each State, in million kilowatthours.

The U.S. total for this series is calculated as the sum of the State data:

SOEGPUS = ΣSOEGPZZ

Electricity produced from photovoltaic and solar thermal energy in the electric power sector is converted from kilowatthours to Btu by using a conversion factor that is the U.S. average heat content of fossil fuels consumed at steam-electric power plants, FFETKUS. The annual values for this factor are shown in Appendix B, Table B1, http://www.eia.doe.gov/emeu/states/_seds_updates_tech_notes.html.

FFETKUS = factor for converting hydroelectric power from kilowatthours to Btu.

The values for the electric power sector in each State are converted to Btu and the U.S. total is the sum of the State data:

SOEGBZZ = SOEGPZZ * FFETKUS
SOEGBUS = ΣSOEGBZZ

Each State's total use of photovoltaic and solar thermal energy sources is the sum of the sectors' values, and the U.S. total is the sum of the States' totals:

SOTCBZZ = SOHCBZZ + SOEGBZZ
SOTCBUS = ΣSOTCBZZ

Data Sources

FFETKUS — Fossil fuel steam-electric power plant conversion factor.

- 1960 through 1988: Estimated by EIA as the weighted annual average heat rate for fossil-fueled steam-electric plants in the United States as published in the EIA, *Electric Plant Cost and Power Production Expenses 1991*, Table 9.
- 1989 forward: Calculated annually by EIA on the basis of data from Form EIA-767 "Steam-Electric Plant Operation and Design Report."

SOEGPZZ — Electricity produced from solar thermal energy sources by the electric power sector by State.

- 1960 through 1983: No data available. Values are assumed to be zero.
- 1984 through 1988: EIA, Form EIA-759, "Monthly Power Plant Report."
- 1989 forward: EIA, Forms EIA-920, "Combined Heat and Power Plant Report," and EIA-906, "Power Plant Report," and predecessor forms.

SOHCBUS — Electricity produced from solar thermal energy sources in the residential and commercial sectors combined in the United States.

- 1960 through 1988: No data available. Values are zero.
- 1989 forward: EIA, *Annual Energy Review 2004,* Table 10.2a.

SOTTPZZ — Electricity produced from solar thermal energy sources in the residential and commercial sectors combined by State.

- 1960 through 1988: Values are set to zero in SEDS for consistency with SOHCBUS.
- 1989 forward: Shipments of solar thermal collectors in the United States, in thousand square feet, for 1974 forward are collected on the EIA Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey," (and predecessor forms) and used to develop this series for 1989 forward. The data are accumulated year to year on the assumption that the replacement/retirement period for solar thermal collectors is 20 years. Data for 1974 through 1985 are available for the U.S. total only and are allocated to the States by using an allocating series that is the average of the 1986 and 1987 shipments (the first years State-level data were collected). The ratios of the average 1986 and 1987 State values to the average 1986 and 1987 U.S. value are applied to the national annual values for each year, 1974 through 1985. Beginning in 1986, the U.S. data are adjusted to remove Puerto Rico and the Virgin Islands. California data for 1986 forward are reduced by the number of high-temperature solar thermal collectors used at an electric utility in California. The sources for these data series are:
  - 1986 through 1993: EIA, *Solar Collector Manufacturing Activity* for each year. The specific table numbers are:
    - 1986 through 1988, 1990: Table 5.
    - 1989: Table 4.
    - 1991 and 1992: Table 13.
    - 1993: Table 12.

    California data for 1986 through 1992 are reduced by the number of high-temperature solar thermal collectors shown in the EIA, *Renewable Energy Annual 1995*, Table 13.
  - 1994 forward: EIA, *Renewable Energy Annual*. Data are from the report of the following year (i.e., 1994 data are published in the *Renewable Energy Annual 1995*) for 1994 through 2000. Beginning in 2001, data are from the report of the same year. The specific tables are:
    - 1994: Tables 13 and H3.
    - 1995: Tables F9 and F10.
    - 1996: Tables 16 and 17.
    - 1997: Tables 15 and 19.
    - 1998 and 1999: Tables 12 and 16.
    - 2000: Unpublished data.
    - 2001 forward: Tables 14 and 18.

Wind

Wind energy used to produce electricity by the electric power sector is included in the State Energy Data System (SEDS) for 1983 forward. The data are identified in SEDS by the following name ("ZZ" in the variable name represents the two-letter State code that differs for each State):

WYEGPZZ = electricity produced from wind energy by the electric power sector, by State, in million kilowatthours; and

The U.S. total is calculated as the sum of the State data:

WYEGPUS =ΣWYEGPZZ

Electricity produced from wind energy by the electric power sector is converted from kilowatthours to British thermal units (Btu) by using a conversion factor that is the U.S. average heat content of fossil fuels consumed at steam-electric power plants, FFETKUS. The annual values for this factor are shown in Appendix B, Table B1, http://www.eia.doe.gov/emeu/states/_seds_updates_tech_notes.html.

FFETKUS = factor for converting hydroelectric power from kilowatthours to Btu.

The values for the electric power sector in each State are converted to Btu and the U.S. total is the sum of the State data:

WYEGBZZ = WYEGPZZ * FFETKUS
WYEGBUS = ΣWYEGBZZ

The State and U.S. totals for wind energy are calculated:

WYTCBZZ = WYEGBZZ
WYTCBUS = ΣWYTCBZZ

Data Sources

FFETKUS — Fossil fuel steam-electric power plant conversion factor.

- 1960 through 1988: Estimated by EIA as the weighted annual average heat rate for fossil-fueled steam-electric plants in the United States as published in the EIA, *Electric Plant Cost and Power Production Expenses 1991*, Table 9.
- 1989 forward: Calculated annually by EIA on the basis of data from Form EIA-767 "Steam-Electric Plant Operation and Design Report."

WYEGPZZ — Electricity produced from wind by the electric power sector by State.

- 1960 through 1982: No data available. Values are assumed to be zero.
- 1983 through 1988: EIA, Form EIA-759, "Monthly Power Plant Report."
- 1989 forward: EIA, Forms EIA-920, "Combined Heat and Power Plant Report," and EIA-906, "Power Plant Report," and predecessor forms.

Wood and Waste

Different forms of wood and waste are used by each consuming sector. The residential sector burns wood for space heating. The commercial sector uses wood for space heating, and wood, municipal waste and land fill gas for steam heat and electricity generation. The industrial sector uses combustible industrial by-products and wood chips for electricity generation and process steam. The electric power sector uses wood, industrial wood waste and waste gas, and municipal waste as cofiring or primary fuels to produce electricity. Consumption of wood and waste in all sectors is included in the State Energy Data System (SEDS) for 1960 forward.

Residential Sector

Physical Units

Estimates of wood consumed in the residential sector by State for 1960 through 1979 are from the Energy Information Administration (EIA) *Estimates of U.S. Wood Energy Consumption from 1949 to 1981*. For 1980 forward, State estimates are developed from U.S. totals published in the EIA *Annual Energy Review (AER)*, from Census division data collected on the EIA triennial survey, *Residential Energy Consumption Survey (RECS)* for 1981, 1984, 1987, 1990, 1993, 1997, and 2001 and from U.S. Department of Commerce, Bureau of the Census, annual estimates of number of housing units per State. The 1981 *RECS* provides wood consumption data for the national total and Census Regions. For all other years, *RECS* provides data for the national total and Census Divisions. In addition, the survey sample size of the 1993, 1997, and 2001 *RECS* were large enough to provide data for California, Florida, New York, and Texas. Estimates for the other States in 1993, 1997, and 2001, and for all States in the other years are developed by allocating the U.S. total from the *AER* to the Census Divisions or Regions in proportion to *RECS* data. The regional values are then allocated to the States within the regions in proportion to the Census Bureau housing units per State. Estimates for the years intervening the *RECS* surveys are based on the annual U.S. totals from the *AER* and the State proportions of the preceding available *RECS*, i.e., 1982 and 1983 estimates are based on the State proportions of the 1981 data. On the basis of *RECS* data, the assumption is made that no wood is consumed in the residential sector in Hawaii.

The State data derived above are used in SEDS as wood consumption in the residential sector, identified in the system as WDRCPZZ. "ZZ" in the following variable name represents the two-letter State code that differs for each State.

WDRCPZZ = wood consumed in the residential sector of each State, in thousand cords.

The State-level data are summed to a U.S. total:

WDRCPUS = ΣWDRCPZZ

British Thermal Units (Btu)

The residential sector data in cords are converted to Btu by using the conversion factor of 20 million Btu per cord:

WDRCBZZ = WDRCPZZ * 20
WDRCBUS = ΣWDRCBZZ

Data Sources

WDRCPZZ — Wood energy consumed by the residential sector by State.

- 1960 through 1979: EIA, *Estimates of U.S. Wood Consumption from 1949 to 1981*, Table A4. Data published in thousand short tons are converted to thousand cords by using the factors of one short ton equals 17.2 million Btu (as published in the footnote of Table A4) and 20 million Btu equal one cord of wood, (as published in EIA, *Household Energy Consumption and Expenditures 1993*, page 314.
- 1980 forward: U.S. totals published in the EIA *Annual Energy Review 1999,* Table 10.4 are converted from trillion Btu to thousand cords (by using the factor of 20 million Btu per cord) and allocated to the States as described below. Hawaii residential wood consumption is assumed to be zero for all years.
  - — 1980 through 1983: U.S. Census Region wood consumption in thousand cords from Form EIA-457, "1981 Residential Energy Consumption Survey" is allocated to the States within each Region in proportion to the U.S. Department of Commerce, Bureau of the Census, *American Housing Survey*, "Total Housing Units for States, July 1, 1981." This derived 1981 State series is used to allocate the *AER* annual U.S. residential wood consumption to the States for 1980 through 1983.
  - — 1984 through 1986: U.S. Census Division wood consumption in thousand cords from Form EIA-457, "1984 Residential Energy Consumption Survey" is allocated to the States within each Division in proportion to the U.S. Department of Commerce, Bureau of the Census, *American Housing Survey*, "Total Housing Units for States, July 1, 1984." This derived 1984 State series is used to allocate the *AER* annual U.S. residential wood consumption to the States for 1984 through 1986.
  - — 1987 through 1989: U.S. Census Division wood consumption in thousand cords from Form EIA-457, "1987 Residential Energy Consumption Survey" is allocated to the States within each Division in proportion to the U.S. Department of Commerce, Bureau of the Census, *American Housing Survey*, "Total Housing Units for States, July 1, 1987." This derived 1987 series is used to allocate the *AER* annual U.S. residential wood consumption to the States for 1987 through 1989.
  - — 1990 through 1992: U.S. Census Division wood consumption in thousand cords are from Form EIA-457, "1990 Residential Energy Consumption Survey." State-level estimates are available for 1993 for California, Florida, New York, and Texas from the Form EIA-457, "1993 Residential Energy Consumption Survey." Those four States' percentages of their respective Division totals in the 1993 survey are applied to the 1990 Census Division data to derive their 1990 values. Wood consumption by the other States in each Division is estimated by allocating the remaining Division data to the States in proportion to the U.S. Department of Commerce, Bureau of the Census, Internet file (ST-98-51) "Estimates of Housing Units,...Annual Time Series,...(includes revised April 1, 1990 census housing...)" column titled "4/1/90 Census" at http://www.census.gov/population/estimates/housing/sthuhh6.txt.. This derived 1990 State series is used to allocate the *AER* annual U.S. residential wood consumption to the States for 1990 through 1992.
  - — 1993 through 1996: Residential wood consumption data for U.S. Census Divisions and for California, Florida, New York, and Texas are from Form EIA-457, "1993 Residential Energy Consumption Survey." Data for the other States in each Division are estimated by allocating the remaining Division data to the States in proportion to the U.S. Department of Commerce, Bureau of the Census, Internet file (ST-98-51) "Estimates of Housing Units,...Annual Time Series, July 1, 1991 to July 1, 1998...," column titled "7/1/93" at http://www.census.gov/population/estimates/housing/sthuhh6.txt. This derived 1993 State series is used to allocate the *AER* annual U.S. residential wood consumption to the States for 1993 through 1996.
  - — 1997 through 2000: Residential wood consumption data for U.S. Census Divisions and for California, Florida, New York, and Texas are from Form EIA-457, "1997 Residential Energy Consumption Survey." Data for the other States in each Division are estimated by allocating the remaining Division data to the States in proportion to the U.S. Department of Commerce, Bureau of the Census, Internet file (ST-98-51) "Estimates of Housing

Units,...Annual Time Series, July 1, 1991 to July 1, 1998...," column titled "7/1/97" at http://www.census.gov/population/estimates/housing/sthuhh6.txt. This derived 1997 State series is used to allocate the *AER* annual U.S. residential wood consumption to the States for 1997 through 2000.

— 2001 forward: Residential wood consumption data for U.S. Census Divisions and for California, Florida, New York, and Texas are from Form EIA-457, "2001 Residential Energy Consumption Survey." Data for the other States in each Division are estimated by allocating the remaining Division data to the States in proportion to the U.S. Department of Commerce, Bureau of the Census, Internet file "Table 1. Annual Estimates of Housing Units for the United States and States: April 1, 2000 to July 1, 2004," column titled "July 1, 2001" at http://www.census.gov/popest/housing/tables/HU-EST2004-01.xls. This derived 2001 State series is used to allocate the *AER* annual U.S. residential wood consumption to the States for 2001 forward.

Commercial Sector

Estimates of wood consumed in the commercial sector by State for 1960 through 1979 are from the EIA, *Estimates of U.S. Wood Energy Consumption from 1949 to 1981*. The data published in thousand short tons are converted to billion Btu by using the conversion factor of one short ton equals 17.2 million Btu. The assumption was made in that report that wood is consumed in the commercial sector in proportion to consumption in the residential sector each year. For 1980 through 1988, national level commercial wood consumption estimates in trillion Btu are from the EIA, *Annual Energy Review*. Using the same methodology as for previous years, the national data are allocated to the States in proportion to residential sector wood use each year.

For 1989 forward, State-level data on wood and waste consumption by commercial combined heat and power (CHP) plants are available from the Form EIA-920, "Combined Heat and Power Plant Report," and predecessor forms. All commercial consumption of waste occurs at CHP plants; however, some wood consumption occurs at other types of commercial establishments. The U.S. total wood consumption in the commercial sector is published in the *AER*. The U.S. total of the State commercial CHP plant wood consumption is subtracted from the *AER* national commercial sector total, and the remainder is allocated to the States in proportion to each State's residential sector wood use each year from 1989 forward.

The data series described above, used to estimate SEDS wood and waste consumption in the commercial sector, are identified as follows ("ZZ" in the variable names represents the two-letter State code that differs for each State):

WDRCPZZ = wood consumed in the residential sector of each State, in thousand cords;
WDCCBUS = wood consumed by the commercial sector in the United States, in billion Btu;
WDC3BZZ = wood consumed by CHP facilities in the commercial sector of each State, in billion Btu; and
WSC3BZZ = waste consumed by CHP facilities in the commercial sector of each State, in billion Btu.

The U.S. totals for the State-level series are calculated as the sum of the State data:

WDRCPUS = ΣWDRCPZZ
WDCCBUS = ΣWDCCBZZ
WDC3BUS = ΣWDC3BZZ
WSC3BUS = ΣWSC3BZZ

The national total wood consumed by commercial entities other than CHP facilities are calculated as shown below, and those volumes are allocated to the States in proportion to the residential wood consumption series as follows:

WDC4BUS = WDCCBUS – WDC3BUS
WDC4BZZ = (WDRCPZZ / WDRCPUS) * WDC4BUS

State totals of commercial wood consumption is calculated as the sum of consumption by CHP facilities and the remaining commercial sector:

WDCCBZZ = WDC3BZZ + WDC4BZZ

Total commercial consumption of waste is set equal to the commercial consumption of waste by CHP facilities, which are the only commercial

facilities with waste consumption, and the U.S. total is calculated as the sum of the State values.

WSCCBZZ = WSC3BZZ
WSCCBUS = ΣWSCCBZZ

The total wood and waste consumption in the commercial sector is calculated as the sum of wood consumption and waste consumption, and the U.S. total is calculated as the sum of the State data:

WWCCBZZ = WDCCBZZ + WSCCBZZ
WWCCBUS = ΣWWCCBZZ

Data Sources

WDC3BZZ — Wood energy consumed by CHP facilities in the commercial sector of each State.

- 1989 forward: EIA, Forms EIA-920, "Combined Heat and Power Plant Report," and predecessor forms.

WDCCBUS — Wood consumed by the commercial sector in the United States.

- 1960 through 1979: EIA, *Estimates of U.S. Wood Energy Consumption from 1949 to 1981*, Table A7. Data published in thousand short tons are converted to Btu using the factor of one short ton equals 17.2 million Btu (as stated in the footnote of Table A7).
- 1980 forward: EIA, data in billion Btu shown in trillion Btu in the *Annual Energy Review 2005*, Table 10.2a.

WSC3BZZ — Waste energy consumed by CHP facilities in the commercial sector of each State.

- 1989 forward: EIA, Forms EIA-920, "Combined Heat and Power Plant Report," and predecessor forms.

WDRCPZZ — Wood energy consumed by the residential sector by State.

See sources on page 87.

Industrial Sector

Industrial sector wood and waste consumption estimates by State for 1960 through 1979 are from the EIA, *Estimates of U.S. Wood Energy Consumption from 1949 to 1981*. The data, published in thousand short tons, are converted to billion Btu using the factor 1 short ton equals 17.2 million Btu.

Estimates for 1980 through 1995 are based on a national-level data series published for 1949 forward in the EIA *Annual Energy Review (AER)*. National wood and waste consumption by type is collected by Standard Industrial Classification (SIC) on the EIA triennial survey Form EIA-846, "Manufacturing Energy Consumption Survey" (MECS) for 1985, 1988, 1991, and 1994. The assumption is made that wood and waste use in the manufacturing sector occurs primarily in the industries included in SIC series 2421 (sawmills and planing mills), 2511 (wood household furniture), 2621 (paper mills), 2046 (wet corn milling), and 2061 (raw cane sugar). The amount of wood and waste consumed by each of the SIC groups of industries is estimated from the MECS data, and the MECS proportions are used to allocate the U.S. totals from the *AER* to SIC groups for each year. The SIC annual subtotals are allocated to the States using State-level data on the value added in manufacturing processes for each of the SIC series listed above, as published in the U.S. Department of Commerce, Bureau of the Census, *Census of Manufacturers, Industry Series*, for 1982, 1987, and 1992.

Estimates for 1996 forward use the same methodology used for 1980 through 1995 with the exception that the Bureau of the Census *Economic Census* for 1997 and 2002 use North American Industry Classification System (NAICS) instead of Standard Industrial Classifications. Some categories used in the two classification systems are directly comparable (NAICS 311221 to SIC 2046, NAICS 311311 to SIC 2061, and NAICS 322130 to SIC 2631), some are closely (over 97 percent) comparable (NAICS 337122 to SIC 2511 and the sum of NAICS 321113 and 321912 to SIC 2421), and one is roughly (74 percent) comparable (NAICS 322121 to SIC 2621). The EIA survey Form EIA-846, MECS, also uses NAICS codes in the surveys for 1998 and 2002. The discontinuity in these State allocating series caused by the change from SIC to NIACS categories is not significant in light of the broad assumptions of the estimation methodology.

For 1989 forward, State-level data on wood and waste consumption by industrial combined heat and power (CHP) facilities are available from the

Form EIA-920, "Combined Heat and Power Plant Report," and predecessor forms. These data are used with the manufacturing data to estimate total industrial sector wood and waste consumption for each State.

Industrial wood and waste consumption is expressed in Btu because its components are physically measured in a variety of units (e.g., tons, cubic feet, and kilowatthours). Industrial wood and waste data series are identified in SEDS by the following names ("ZZ" in the variable name represents the two-letter State code that differs for each State):

WDI3BZZ = wood consumed by CHP facilities in the industrial sector in each State, in billion Btu;
WDI4BZZ = wood consumed by the manufacturing portion of the industrial sector of each State, in billion Btu;
WSI3BZZ = waste consumed by CHP facilities in the industrial sector in each State, in billion Btu; and
WSI4BZZ = waste consumed by the manufacturing portion of the industrial sector of each State, in billion Btu.

The U.S. totals of the State series are calculated as the sum of the State data:

WDI3BUS = ΣWDI3BZZ
WDI4BUS = ΣWDI4BZZ
WSI3BUS = ΣWSI3BZZ
WSI4BUS = ΣWSI4BZZ

The U.S. total for wood consumed by the industrial sector is calculated as the sum of consumption by CHP facilities and the manufacturing sector, and the U.S. total is calculated as the sum of the State data:

WDICBZZ = WDI3BZZ + WDI4BZZ
WDICBUS = ΣWDICBZZ

The U.S. total for waste consumed by the industrial sector is calculated as the sum of consumption by CHP facilities and the manufacturing sector, and the U.S. total is calculated as the sum of the State data:

WSICBZZ = WSI3BZZ + WSI4BZZ
WSICBUS = ΣWSICBZZ

The total manufacturing sector is calculated as the sum of wood consumption and the sum of waste consumption, and the U.S. total is calculated as the sum of the State data:

WWI4BZZ = WDI4BZZ + WSI4BZZ
WWI4BUS = ΣWWI4BZZ

The total industrial sector is calculated as the sum of wood consumption and the sum of waste consumption, and the U.S. total is calculated as the sum of the State data:

WWICBZZ = WDICBZZ + WSICBZZ
WWICBUS = ΣWWICBZZ

Data Sources

WDI3BZZ — Wood consumed by CHP facilities in the industrial sector by State.

- 1960 through 1988: No data available. Values are assumed to be zero.
- 1989 forward: EIA, Form EIA-920, "Combined Heat and Power Plant Report," and predecessor forms.

WDI4BZZ — Wood consumed by the manufacturing sector by State.

- 1960 through 1979: EIA, *Estimates of U.S. Wood Energy Consumption from 1949 to 1981*, Table A10. Data published in thousand short tons are converted to Btu by using the factor of one short ton equals 17.2 million Btu (as published in the footnote of Table A10).
- 1980 forward: EIA estimates developed by using three data sources. U.S. totals for each year are as published for selected years in the EIA, *Annual Energy Review 2005 (AER)*, Table 10.2a.
  - 1980 through 1985: U.S. totals from the *AER* are allocated to Standard Industrial Classification (SIC) groups 20, 24, 25, and 26 based on data from the Form EIA-846, "Manufacturing Energy Consumption Survey 1985," Table 3, Columns "Major Byproducts" and "Other." These SIC subtotals are allocated to the States using State-level series from the U.S. Department of Commerce, Bureau of the Census, *1982 Census of Manufacturers,* Table 2, column titled "Value Added by Manufacturer," from the publications for Industry 2061 Raw Cane Sugar, Industry 2046 Wet

Corn Milling, Industry 2421 Sawmills and Planing Mills, Industry 2511 Wood Household Furniture, Industry 2621 Paper Mills, and Industry 2631 Paperboard Mills. The State values for each of the four SIC groups are summed to derive State total wood and waste industrial consumption estimates.

— 1986 through 1989: U.S. totals from the *AER* are allocated to SIC groups 20, 24, 25, and 26 based on data from the Form EIA-846, "Manufacturing Energy Consumption Survey 1988," Tables 2 and 18, columns "Pulping Liquor," "Roundwood," and "Wood Chips." These SIC subtotals are allocated to the States using State-level series from the U.S. Department of Commerce, Bureau of the Census, *1987 Census of Manufacturers,* Table 2, column titled "Value Added by Manufacturer," from the publications for Industry 2061 Raw Cane Sugar, Industry 2046 Wet Corn Milling, Industry 2421 Sawmills and Planing Mills, Industry 2511 Wood Household Furniture, Industry 2621 Paper Mills, and Industry 2631 Paperboard Mills. The State values for each of the four SIC groups are summed to derive State total industrial wood consumption estimates.

  For 1989 only, State-level data on wood consumption by combined heat and power (CHP) facilities are available from the Form EIA-867, "Annual Nonutility Power Producer Report" in billion Btu. These CHP State data are summed and subtracted from the *AER* U.S. total. The remaining value is assumed to be the manufacturing sector and is allocated to the States using the method above. The State values for each of the four SIC groups and the CHP facilities are summed to derive State total industrial wood consumption estimates.

— 1990 through 1993: State-level data on wood consumption by CHP facilities from the Form EIA-867, "Annual Nonutility Power Producer Report" in billion Btu are summed and subtracted from the *AER* U.S. total. The remaining national value is allocated to SIC groups 20, 24, 25, and 26 based on unpublished data on pulping liquor, roundwood, and wood chips from the Form EIA-846, "Manufacturing Energy Consumption Survey 1991 (MECS)." SIC groups 20 and 26 are grouped as "Other" in MECS. The proportions of those two groups in the 1988 and 1994 MECS are averaged and used to estimate the breakout for 1991. These SIC subtotals are allocated to the States using State-level series from the U.S. Department of Commerce, Bureau of the Census, *1992 Census of Manufacturers,* Table 2, column titled "Value Added by Manufacturer," from the publications for Industry 2061 Raw Cane Sugar, Industry 2046 Wet Corn Milling, Industry 2421 Sawmills and Planing Mills, Industry 2541 Wood Partitions and Fixtures, and Industry 2621 Paper Mills. The State values for each of the four SIC groups and the CHP facilities are summed to derive State total industrial wood consumption estimates.

— 1994 and 1995: State-level data on wood consumption by CHP facilities from the Form EIA-867, "Annual Nonutility Power Producer Report" in billion Btu are summed and subtracted from the *AER* U.S. total. The remaining national value is allocated to SIC groups 20, 24, 25, 26, and "Other" based on data from the Form EIA-846, "1994 Manufacturing Energy Consumption Survey," Table A7, columns "Pulping or Black Liquor," "Wood from Trees," and "Wood from Mills." These SIC subtotals are allocated to the States using State-level series from the U.S. Department of Commerce, Bureau of the Census, *1992 Census of Manufacturers,* Table 2, column titled "Value Added by Manufacturer," from the publications for Industry 2061 Raw Cane Sugar, Industry 2046 Wet Corn Milling, Industry 2421 Sawmills and Planing Mills, Industry 2511 Wood Household Furniture, Industry 2621 Paper Mills, and Industry 2631 Paperboard Mills. The State values for each of the five SIC groups and the CHP facilities are summed to derive State total industrial wood consumption estimates.

— 1996 and 1997: State-level data on wood consumption by CHP facilities from the Form EIA-867, "Annual Nonutility Power Producer Report," in billion Btu are summed and subtracted from the *AER* U.S. total. The remaining national value is allocated to SIC groups 20, 24, 25, 26, and "Other" based on data from the Form EIA-846, "1994 Manufacturing Energy Consumption Survey," Table A7, columns "Pulping or Black Liquor," "Wood from Trees," and "Wood from Mills." These SIC subtotals are allocated to the States using State-level series from the U.S. Department of Commerce, Bureau of the Census, *1997 Economic Census.* In the *Economic Census* the SIC groupings for the State data are replaced by North American Industry Classification System (NAICS) industry groups. The two industry classification systems are not identical, but NAICS groups are chosen that compare with SIC categories as closely as possible. The State series are from Table 2, column titled "Value Added by

Manufacturer," from the publications for NAICS Industry 311221 Wet corn milling (for SIC 20 Food), Industry 321113 Sawmills and Industry 3212 Engineered wood product manufacturing (for SIC 24 Wood), Industry 3372 Office furniture manufacturing (for SIC 25 Furniture), Industry 322121 Paper mills, and Industry 322130 Paperboard mills (for SIC 26 Paper), and Industry 313 Textile mills (for Other SIC). The State values for each of the five NAICS group subtotals and the CHP facilities are summed to derive State total industrial wood consumption estimates.

— 1998 forward: State-level data on wood consumption by CHP facilities from the Form EIA-920, "Combined Heat and Power Plant Report," and predecessor forms, in billion Btu are summed and subtracted from the *AER* U.S. total. The remaining national value is allocated to NAICS industry groups 311, 321, 337, and 322, and "Other" based on data from the Form EIA-846, "Manufacturing Energy Consumption Survey," 1998 (for 1998–2001) and 2002 (for 2002 forward), Table A7, columns "Pulping or Black Liquor," "Wood from Trees," and "Wood from Mills." These NAICS subtotals are allocated to the States using State-level series from the U.S. Department of Commerce, Bureau of the Census, *Economic Census* for 1997 (1998–2000) and 2002 (2001 forward). The State series are from Table 2, column titled "Value Added by Manufacturer," from the publications for NAICS Industry 311221 Wet corn milling (for NAICS 311 Food), Industry 321113 Sawmills and Industry 3212 Engineered wood product manufacturing (for NAICS 321 Wood products), Industry 3372 Office furniture manufacturing (for NAICS 337 Furniture), Industry 322121 Paper mills, and Industry 322130 Paperboard mills (for NAICS 322 Paper), and Industry 313 Textile mills (for Other NAICS). The State values for each of the five NAICS group subtotals and the CHP facilities are summed to derive State total industrial wood consumption estimates.

WSI3BZZ — Waste consumed by CHP facilities in the industrial sector by State.

- 1960 through 1988: No data available. Values are assumed to be zero.
- 1989 forward: EIA, Form EIA-920, "Combined Heat and Power Plant Report," and predecessor forms.

WSI4BZZ — Waste consumed by the manufacturing sector by State.

- 1960 through 1980: No data available. Values assumed to be zero.
- 1981 forward: EIA estimates developed by using three data sources. U.S. totals for each year are as published for selected years in the EIA, *Annual Energy Review 2005 (AER)*, Table 10.2a.
  - — 1981 through 1985: U.S. totals from the *AER* are allocated to Standard Industrial Classifications (SIC) groups 20, 24, 25, and 26 based on data from the EIA "Manufacturing Energy Consumption Survey 1985 (MECS)," Table 3, columns "Major Byproducts" and "Other." These SIC subtotals are allocated to the States using State-level series from the U.S. Department of Commerce, Bureau of the Census, *1982 Census of Manufacturers,* Table 2, column titled "Value Added by Manufacturer," from the publications for Industry 2061 Raw Cane Sugar, Industry 2046 Wet Corn Milling, Industry 2421 Sawmills and Planing Mills, Industry 2511 Wood Household Furniture, Industry 2621 Paper Mills, and Industry 2631 Paperboard Mills. The State values for each of the four SIC groups are summed to derive State total industrial waste consumption estimates.
  - — 1986 through 1989: U.S. totals from the *AER* are allocated to SIC groups 20, 24, 25, and 26 based on data from the Form EIA-846, "Manufacturing Energy Consumption Survey 1988," Tables 2 and 18, columns "Waste," and "Biomass." These SIC subtotals are allocated to the States using State-level series from the U.S. Department of Commerce, Bureau of the Census, *1987 Census of Manufacturers,* Table 2, column titled "Value Added by Manufacturer," from the publications for Industry 2061 Raw Cane Sugar, Industry 2046 Wet Corn Milling, Industry 2421 Sawmills and Planing Mills, Industry 2511 Wood Household Furniture, Industry 2621 Paper Mills, and Industry 2631 Paperboard Mills. The State values for each of the four SIC groups are summed to derive State total industrial waste consumption estimates.

    For 1989 only, State-level data on waste consumption by CHP facilities are available from the Form EIA-867, "Annual Nonutility Power Producer Report" in billion Btu. These CHP State data are summed and subtracted from the *AER* U.S. total. The remaining value is assumed to be the manufacturing sector and is allocated to the States using the method above. The State values for each of the four SIC groups and the CHP facilities are

summed to derive State total industrial waste consumption estimates.

— 1990 through 1993: State-level data on waste consumption by CHP facilities from the Form EIA-867, "Annual Nonutility Power Producer Report" in billion Btu are summed and subtracted from the *AER* U.S. total. The remaining national value is allocated to SIC groups 20, 24, 25, and 26 based on unpublished data on waste and biomass from the Form EIA-846, "Manufacturing Energy Consumption Survey 1991 (MECS)." SIC groups 20 and 26 are grouped as "Other" in MECS 1991. The proportions of those two groups in the 1988 and 1994 MECS are averaged and used to estimate the breakout for 1991. These SIC subtotals are allocated to the States using State-level series from the U.S. Department of Commerce, Bureau of the Census, *1992 Census of Manufacturers,* Table 2, column titled "Value Added by Manufacturer," from the publications for Industry 2061 Raw Cane Sugar, Industry 2046 Wet Corn Milling, Industry 2421 Sawmills and Planing Mills, Industry 2541 Wood Partitions and Fixtures, and Industry 2621 Paper Mills. The State values for each of the four SIC groups and the CHP facilities are summed to derive State total industrial waste consumption estimates.

— 1994 and 1995: State-level data on waste consumption by CHP facilities from the Form EIA-867, "Annual Nonutility Power Producer Report" in billion Btu are summed and subtracted from the *AER* U.S. total. The remaining national value is allocated to SIC groups 20, 24, 25, 26, and "Other" based on data from the Form EIA-846, "1994 Manufacturing Energy Consumption Survey," Table A7, columns "Agricultural Waste" and "Wood and Paper Refuse." These SIC subtotals are allocated to the States using State-level series from the U.S. Department of Commerce, Bureau of the Census, *1992 Census of Manufacturers,* Table 2, column titled "Value Added by Manufacturer," from the publications for Industry 2061 Raw Cane Sugar, Industry 2046 Wet Corn Milling, Industry 2421 Sawmills and Planing Mills, Industry 2511 Wood Household Furniture, Industry 2621 Paper Mills, and Industry 2631 Paperboard Mills. The State values for each of the five SIC groups and the CHP facilities are summed to derive State total industrial waste consumption estimates.

— 1996 and 1997: State-level data on waste consumption by CHP facilities from the Form EIA-867, "Annual Nonutility Power Producer Report" or Form EIA-860, "Annual Electric Generator Report" in billion Btu are summed and subtracted from the *AER* U.S. total. The remaining national value is allocated to SIC groups 20, 24, 25, 26, and "Other" based on data from the Form EIA-846, "1994 Manufacturing Energy Consumption Survey," Table A7, columns "Agricultural Waste" and "Wood and Paper Refuse." These SIC subtotals are allocated to the States using State-level series from the U.S. Department of Commerce, Bureau of the Census, *1997 Economic Census*. In the *Economic Census* the SIC groupings for the State data are replaced by North American Industry Classification System (NAICS) industry groups. The two industry classification systems are not identical, but NAICS groups are chosen that compare with SIC categories as closely as possible. The State series are from Table 2, column titled "Value Added by Manufacturer," from the publications for NAICS Industry 311311 Sugar cane mills, and Industry 311221 Wet corn milling (for SIC 20 Food), Industry 321912 Cut stock, resawing lumber, and planing (for SIC 24 Wood), Industry 3372 Office furniture manufacturing (for SIC 25 Furniture), Industry 322122 Newsprint mills, and Industry 322130 Paperboard mills (for SIC 26 Paper), and Industry 313 Textile mills (for Other SIC). The State values for each of the five NAICS group subtotals and the CHP facilities are summed to derive State total industrial waste consumption estimates.

— 1998 forward: State-level data on waste consumption by CHP facilities from the Form EIA-920, "Combined Heat and Power Plant Report," and predecessor forms, in billion Btu are summed and subtracted from the *AER* U.S. total. The remaining national value is allocated to NAICS industry groups 311, 321, 337, and 322, and "Other" based on data from the Form EIA-846, "Manufacturing Energy Consumption Survey," 1998 (for 1998–2001) and 2002 (for 2002 forward), Table A7, columns "Agricultural Waste" and "Wood and Paper Refuse." These NAICS subtotals are allocated to the States using State-level series from the U.S. Department of Commerce, Bureau of the Census, *Economic Census* for 1997 (1998–2000) and 2002 (2001 forward). The State series are from Table 2, column titled "Value Added by Manufacturer," from the publications for NAICS Industry 311311 Sugar cane mills, and Industry 311221 Wet corn milling (for SIC 20 Food), Industry 321912 Cut stock, resawing lumber, and planing (for SIC 24 Wood), Industry 3372 Office furniture manufacturing (for SIC 25 Furniture), Industry 322122

Newsprint mills, and Industry 322130 Paperboard mills (for SIC 26 Paper), and Industry 313 Textile mills (for Other SIC). The State values for each of the five NAICS group subtotals and the CHP facilities are summed to derive State total industrial waste consumption estimates.

Electric Power Sector

Electric power sector generation of electricity from wood and waste energy, by State, are available combined from 1960 through 1981 and separately from 1982 forward from Form EIA-906, "Power Plant Report," and predecessor forms.

The data series are identified in SEDS by the following names ("ZZ" in the variable name represents the two-letter State code that differs for each State):

WDEIBZZ = wood consumed by the electric power sector in each State (included in waste energy for 1960 through 1981), in million Btu; and
WSEIBZZ = waste consumed by the electric power sector in each State (includes wood energy for 1960 through 1981), in million Btu.

The U.S. totals are calculated as the sum of the State data, and wood and waste are summed to provide a total (WW) value:

WDEIBUS = ΣWDEIBZZ
WSEIBUS = ΣWSEIBZZ

WWEIBZZ = WDEIBZZ + WSEIBZZ
WWEIBUS = ΣWWEIBZZ

Data Sources

WDEIBZZ — Wood consumed by the electric power sector by State.

- 1960 through 1981: Data included in waste energy sources, see WSEIBZZ.
- 1982 forward: EIA, Form EIA-906, "Power Plant Report," and predecessor forms.

WSEIBZZ — Waste consumed by the electric power sector by State.

- 1960 forward: EIA, Form EIA-906, "Power Plant Report," and predecessor forms (includes wood energy sources from 1960 through 1981).

Totals

State total consumption of wood and waste is calculated as the sum of the consumption in the residential, commercial, and industrial sectors as well as consumption by the electric power sector. The U.S. total is the sum of the State data:

WDTCBZZ = WDRCBZZ + WDCCBZZ + WDICBZZ + WDEIBZZ
WDTCBUS = ΣWDTCBZZ

WSTCBZZ = WSCCBZZ + WSICBZZ + WSEIBZZ
WSTCBUS = ΣWSTCBZZ

WWTCBZZ = WDTCBZZ + WSTCBZZ
WWTCBUS = ΣWWTCBZZ

Additional Calculations

Additional calculations are made in SEDS to aggregate some data series to be shown in the tables of this report. Geothermal, wind, photovoltaic, solar thermal energy sources, and net imports of electricity are combined to be shown in the "Other" column in tables titled "Energy Consumption Estimates by Source." The variables are calculated for each State and the United States in billion Btu as follows:

GOTCBZZ = GETCBZZ + SOTCBZZ + WYTCBZZ + ELNIBZZ
GOTCBUS = ΣGOTCBZZ

Renewable Energy Total

Renewable energy subtotals for each consuming sector in thousand Btu can be calculated for 1989 forward by using the same formulas for each State and the U.S. totals.

REACB = ENACB

RECCB = GECCB + HYCCB + WWCCB

REEIB = HVEGB + GEEGB + SOEGB + WWEIB + WYEGB

REICB = GEICB + HVICB + WWICB

RERCB = WDRCB + GERCB + SOHCB

RETCB = RERCB + RECCB + REICB + REACB + REEIB